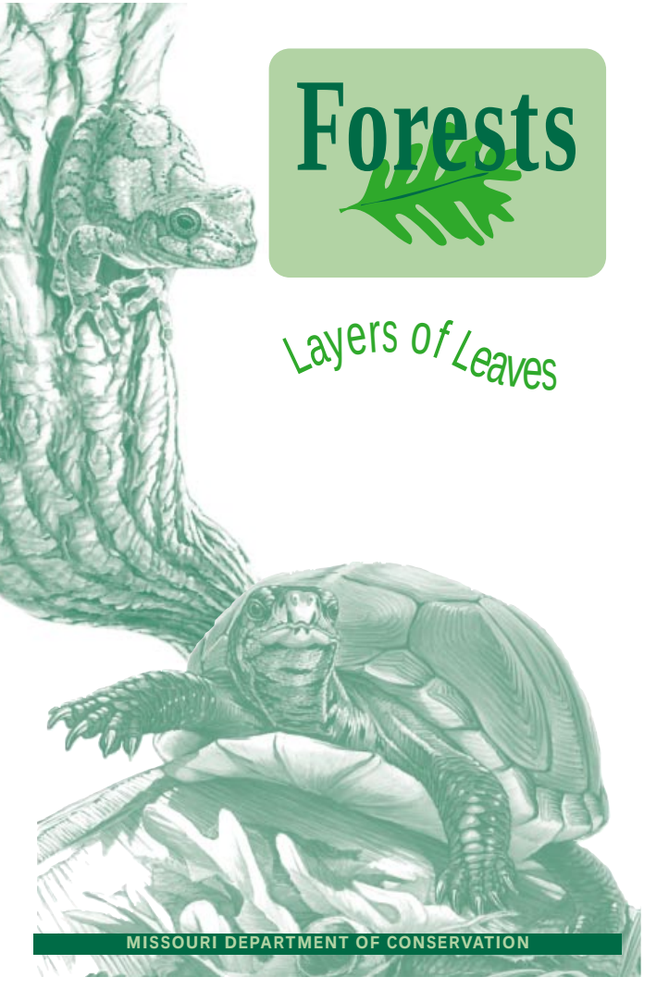
Layers of Leaves



Forests

Layers of Leaves

MISSOURI DEPARTMENT OF CONSERVATION

Missouri Forests

When the first Europeans arrived, about two-thirds of Missouri (30 million acres) was forested. Today, nearly one-third of Missouri (14 million acres) is forested. Of the forests here, the oak-hickory type is the most common. Missouri's forest types have three major layers of plant and animal life called canopy, understory and forest floor.

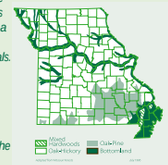
Canopy The top layer of the forest is the canopy. Oak and hickory trees dominate the canopy of oak-hickory forests. The canopy receives most of the sunlight, shading the plants beneath. The trees of the canopy serve many functions. Their leaves lessen the impact of rain on the forest floor, allowing rainwater to soak slowly into the soil. The trees are an important source of food for squirrels, turkeys, deer and other wildlife. They eat the acorns, hickory nuts and other fruits. Insects feed on the leaves of the canopy and many animals, especially birds, feed on the insects. The trees provide nesting and den sites for wildlife. In fall, most of the leaves are shed onto the forest floor and nutrients are released into the soil, sustaining new plant growth.

Understory The middle layer of the forest or understory consists of smaller trees such as dogwood, redbud, serviceberry, buckeye, hornbeam and pawpaw that have adapted to the canopy's shade. Seedlings of the forest canopy trees are also found growing in the understory. Shrubs and vines, such as hazelnut, Virginia creeper, wild grape, poison ivy, sumac and spicebush, are part of the understory. Many animals find food here and, in turn, the animals become food for other forest wildlife.

Forest Floor The forest floor supports a diversity of life. Ferns, mosses, grasses and wildflowers bloom and grow quickly in early spring before the leaves of the canopy emerge to block the sunlight. The forest floor recycles the remains of dead plants and animals with help from fungi, bacteria and other decomposers. The carpet of humus (or decaying matter) absorbs and holds the moisture essential for decomposition. The forest floor has rich soils to provide the nutrients, oxygen, water and minerals the plants need. The soil is also home for many organisms–mammals, amphibians, reptiles, worms, insects and spiders. Some wildlife burrow into the soil and overwinter, with leaves and debris to insulate them from winter's cold.

MISSOURI FOREST TYPES

Missouri is on the western edge of the central hardwood forest of the United States. This type of forest has a great diversity of plants and animals. Being at the geographic center of the country, Missouri also has trees commonly found farther to the north, east and south. Here are the four main forest types in Missouri.



Oak-hickory
WHERE: Uplands; oak-hickory covers the greatest area in Missouri
CANOPY TREES: Oaks dominate, with white, black, scarlet and northern red oak the most common; post and blackjack oak on drier areas; southern red, chinkapin, bur and pin oak less common; hickories mixed with the oaks; also blackgum, red and sugar maple, ash, elm, black walnut and redcedar
UNDERSTORY TREES: Flowering dogwood, sassafras, redbud, serviceberry and hornbeams.

Oak-pine
WHERE: Uplands on the drier sites in the southern and southeastern Ozarks
CANOPY SPECIES: Similar to oak-hickory, except shortleaf pine present (Missouri's only native pine)
UNDERSTORY SPECIES: Similar to oak-hickory

Mixed Hardwoods
WHERE: One small area in southeast Missouri known as Crowley's Ridge (a remnant from the geologic period when the Ozarks and Appalachians were one mountain chain)
CANOPY SPECIES: Yellow-poplar, sweetgum, white oak, northern red oak, American beech and sugar maple; black, scarlet and cherrybark oaks, white ash, red maple and blackgum occur frequently; hickory usually present
UNDERSTORY SPECIES: Flowering dogwood, redbud, American holly, hazel-alder, serviceberry, American hazel and American hornbeam

Bottomland Hardwoods
WHERE: Floodplains adjacent to rivers and streams; Bootheel of southeast Missouri; land covered with standing water for long periods (Bootheel swamps); occasional flooding
CANOPY SPECIES: Pin and bur oak, cottonwood, elm, ash, willow, river birch, silver maple, sycamore, hackberry, sugarberry, pecan and sweetgum; also baldcypress, water tupelo, and Nuttall, willow, cherrybark, overcup, swamp chestnut and water oaks in Bootheel

Plants and Animals

1. Bobcat *Lynx rufus*
Size: 57-127 cm (22-50") long
Bobcats are medium-sized cats with a short or bobbed tail , one of Missouri's largest wild mammals. They live in bottomland forests or heavy forest cover with thick underbrush, clearings and rocky outcrops. When hunting, bobcats rely more on eyesight and hearing than smell. Bobcats stalk prey by creeping quietly, then pouncing. Meals are mostly rabbit, but bobcats eat other mammals.

2. Fox Squirrel *Sciurus niger*
Size: 48-73 cm (19-29") long
Fox squirrels live in hardwood forests and urban areas with oak and hickory trees. They are most active in fall when the nut crop ripens, their main food. Many buried nuts are not recovered, so they sprout and become trees. Fox squirrels live alone, although young may stay with the female all winter. They live in leafy nests and tree cavities but spend as much time foraging on the ground.

3. White-tailed Deer
Odocoileus virginianus
Size: 122-198 cm (48-77") long
When startled, white-tailed deer run away and raise their flag-like tails in alarm. Deer live in wooded areas, preferring food found at the edges of forests and clearings. They browse and feed on leaves, twigs and fruits of woody plants. When acorns fall in autumn, they become the main food, but deer also eat fungi, mosses and grasses. Deer bed down most of the day and feed just before dark and often before dawn.

4. Woodland Vole
Microtus pinetorum
Size: 82-146 mm (3 1/4-5 3/4") long
A vole is a small, stout mouse that tunnels in the forest soil under leaves and grass, and eats plants, berries and seeds found in the tunnels. Vole predators include snakes, coyotes, foxes, raccoons and minks. Missouri has three kinds of voles, each adapted to a different habitat-meadow, woodland and prairie.

5. Wild Turkey
Meleagris gallopavo
Size: 94-117 cm (37-46")long
Turkeys use different habitats for feeding and nesting. They spend about half of the year in hardwood forests. Nesting habitat is an open area at the edge of a forest or in a grassland. Turkeys eat acorns year-round, along with insects, seeds and other nuts.

6. White-breasted Nuthatch *Sitta carolinensis*
Size: 15 cm (5 3/4")
The white-breasted nuthatch is a year-round resident of Missouri forests. They move down trees headfirst, a characteristic unique to the species. Nuthatches feed on insects from tree bark and nest in tree cavities. Their nests are made in an old woodpecker hole and lined with bark shreds, hair and feathers. Nuthatches are easily drawn to bird feeders with suet and sunflower seeds.

7. Great-horned Owl
Bubo virginianus
Size: 56 cm (22")
Tufts of feathers that appear as horns distinguish the great-horned owls from other Missouri owls. They are common residents of woodlands and urban areas.

Great-horned owls nest in tree cavities, but also use large nests. Their nesting begins in winter so the young fledge as spring rodent populations are high. Great-horned owls are nocturnal hunters, perching in treetops to search for rabbits, squirrels, skunks, mice and birds.

8. Pileated Woodpecker
Dryocopus pileatus
Size: 42 cm (16 1/2") long
Pileated woodpeckers have a loud, rattling call heard in Missouri forests, especially in the southern two-thirds of the state. They nest and roost in tree cavities that they hollow out themselves, usually in trees without bark and located in bottomlands. Most of their diet is insects which they find on tree trunks and limbs–a woodpecker eating habit that keeps our trees and forests healthier. Nuts and fruits are also important foods.

9. Ovenbird *Seiurus aurocapillus*
Size: 15 cm (5 3/4") long
Ovenbirds are a large warbler of mature deciduous forests. Listen for their call, "teacher, teacher, teacher," as they go. Ovenbirds feed and nest on the forest floor. The nest has a roof made of leaves and grasses as protection from predators. In summer, ovenbirds migrate to Missouri and the eastern U.S. and Canada. Watch for ovenbirds turning over leaves with their bills in search of snails, worms and insects.

10. Gray Treefrog *Hyla versicolor*
Size: 32-51 mm (1 1/4-2") long
Gray treefrogs are frogs of the forest and Missouri's most common treefrog. Some of the treefrogs are gray, while others are greenish-gray, brown to bright green with a large, white spot below each eye. Like other members of the treefrog family, they are climbers with adhesive toe pads.

11. Rough Green Snake
Opheodrys aestivus
Size: 46-66 cm (18-26")
Rough green snakes are long, slender snakes of Ozark forests. They live in shrubs, vines and low hanging branches of trees near streams and lakes. Their light green color with a white or yellowish belly helps them blend into the leaves. Prey includes insects (especially grasshoppers and caterpillars) and spiders.

12. Tiger Salamander
Ambystoma tigrinum tigrinum
Size: 18-21 cm (7-8 1/4") long
Tiger salamanders rest under logs and come out at night in Missouri forests. They have dark skin with light yellow-gold markings down each side. Salamanders are carnivores, feeding on insects and worms. Also, various predators, including fish, snakes and birds, eat them.

13. Three-toed Box Turtle
Terrapene carolina triunguis
Size: 11-14 cm (4 1/4-5 1/2") long
Three-toed box turtles are a forest species, although they feed in forest edges and brushy fields. The box turtle's hinged bottom shell allows it to retreat inside the shell when threatened by a predator. Younger turtles eat earthworms and insects, while adults eat mostly plants, berries and mushrooms.

14. Walking Stick
Phasmatidae
Size: 75 mm (3") long
Walking sticks look like sticks with legs. They have long, twig-like bodies, angled legs and thin antennae. Young walking sticks in the nymph stage are green and become brown as they mature. Watch for them near oak trees and grapevines. Contrary to popular belief, they don't bite or sting–they are plant eaters. Walking sticks cling to branches during the day, waiting for darkness to feed on foliage.

15. Baldface Hornets
Vespula maculata
Size: 20 mm (3/4") long
Baldface hornets are large, black insects with white or cream-colored markings on the forehead and abdomen. Hornets usually build nests in wooded areas, attaching them to branches, but nests may be built on shrubs or manmade objects. Nests are constructed of paper-like material made from chewed wood fibers mixed with saliva. Hornets are beneficial predators that feed on insects.

16. Io Moth *Automeris io*
Size: 70 mm (2 3/4") wingspan
Io moths are identified by the large eyespot on each hind wing. The eyespots, black with a white dash in the middle, are a form of mimicry to scare away predators. The caterpillars come with their own protection–they are bright green with bristly spines that sting when touched. Io moths live in deciduous forests and suburban areas. Adult Io moths do not feed.

17. Spicebush Swallowtail Caterpillar *Pterourus troilus troilus*
Size: 48 mm (2") long
Spicebush swallowtail caterpillars, found in Missouri forests, feed on spicebush and sassafras. When not feeding, the caterpillars pull a leaf around them to hide. They have a Y-shaped organ that emerges and emits a strong odor when disturbed. Their large eye-like markings are also mimicry to make them appear larger and more threatening. Spicebush swallowtail butterflies feed on the nectar of butterflyweed and other flowers.

18. Termites *Reticulitermes sp.*
Size: 5 mm (1/4")
Termites are important in forests, decomposing dead trees. They tunnel through the wood and break down the fibers with the help of protozoa in their digestive tracts. Besides their role as decomposers, termites are food for animals such as lizards and skinks.

19. Carpenter Ants
Camponotus sp.
Size: 12 mm (1/2")
Carpenter ants build nests in dead trees, logs and stumps. They are light red to black in color and do not sting. Chewing through the tree, they create a network of tunnels. Carpenter ant scouts locate food sources and leave a scent trail from the food source back to their colony. The workers then follow this trail to the food, usually insects, seeds or fruits.

20. Sowbug *Porcellio sp.*
Size: 9 mm (3/8")
Sowbugs can be found in damp areas under logs and rocks in Missouri forests. As decomposers, they feed on dead plants and animals.

21. Centipede
Chilopoda
Size: 48 mm (2")
Centipedes are nocturnal animals found in forests under bark, leaves, rotting wood or other debris. As carnivores, centipedes eat insects and spiders.

22. Earthworm *Lumbricidae*
Size: 2-15 cm (3/4-5 3/4")
Earthworms live in moist forest soil, burrowing through the soil and creating tunnels. Earthworms are beneficial as decomposers, feeding on dead plants and helping to aerate the soil as they move along. Also, they are an important food for many animals, including birds, snakes and mammals.

23. Cicada Nymph *Cicadidae*
Size: 29 mm (1 1/4")
Cicada nymphs have four needle-like stylets as part of their mouths to help them pull out fluids from plant roots in the forest soil. Nymphs live in the soil for up to 20 years, then they crawl out onto a trunk, the back of their skins split and the adults emerge. Adult cicadas, sometimes called locusts or harvestflies, can be found on trees in summer. They often fly away when approached, making a buzzing noise.

24. Junebug Grub *Phyllophaga sp.*
Size: 24 mm (1")
Junebug grubs live in the soil and feed on roots for 2 to 3 years. Many animals eat the grubs, especially birds, skunks and raccoons. The adult beetles are common at outdoor lights in early summer. They feed on leaves and flowers.

25., 30. White Oak and Acorn *Quercus alba*
Size: 25-30 m (80-100 ft.) tall
White oaks grow best in deep, moist soils of lower forests, but they grow in many conditions statewide. The leaves have 7-9 rounded lobes with smooth edges. The acorn, about 3/4" long, is shiny brown with a thick warty cap and an important wildlife food. White oaks are also valuable as wildlife cover and lumber.

26. Flowering Dogwood
Cornus florida
Size: 10 m (30 ft.) tall
The flowering dogwood is Missouri's state tree. Of the several species of dogwood in Missouri, flowering dogwood is the best known and the only one with showy spring blooms. The fruit is an oblong drupe, bright green in summer and brilliant scarlet in autumn. Wild turkeys and other forest birds feed on the fruits.

27. Oak and Hickory Forest
Missouri forests are primarily the oak-hickory type. Although oak and hickory trees dominate, other trees such as ash, walnut, maple and redcedar are also found in oak-hickory forests. The forest produces nuts and berries that support many birds and animals.

28. Redcedar *Juniperus virginiana*
Size: 12-18 m (40-60 ft.) tall
Redcedars grow on almost any soil type all across Missouri, from river bottomland to bare rock bluff. Redcedar trees quickly invade abandoned or poorly managed pastures. Redcedars are an excellent tree for wildlife. Animals use them both as food and shelter in the cold winter months, and even deer browse on them in winter. Berries are winter food by many songbirds–birds, in turn, scatter the seeds.

29. Red Maple Seeds
Acer rubrum
Size: 2.5 cm (1") long
Maples have seeds that are often described as helicopters when they whirl and fall each spring. The spinning seeds not only travel away from the parent tree, but spin into the ground to help plant the seed. Many small mammals gather and eat the seeds. Red maple trees are found in forest areas with moist soil.

31., 33. Hickory Nut and Seedling *Carya*
Eight species of hickory trees grow in Missouri forests. Hickory nut hulls are divided into four parts that dry and fall away as the nut ripens. The nuts, an important food for squirrels and other wildlife, are also edible by people. Most hickory nuts taste similar to pecans.

32. Sassafras Seedling
Sassafras albidum
Sassafras is common in southern Missouri, growing best in deep, moist soils. A pioneer species, sassafras is one of the first trees to invade abandoned fields. The blue berries with fleshy red stalks ripen in autumn. Squirrels, quail, wild turkey and other animals eat the berries.

34. Virginia Creeper Vine
Parthenocissus quinquefolia
Size: vine to 30 m (100 ft.) high
Virginia creeper is a vine of the grape family, often confused with poison ivy. To identify the vines, Virginia creeper has five leaflets instead of three. Its berries provide food for birds in fall and winter. Virginia creeper grows in rich woods and on riverbanks.

35. Mayapples
Podophyllum peltatum
Size: 45 cm (18")
Mayapples grow in rich woodlands and thickets. In early spring, they emerge and open up like tiny umbrellas. Plants have one or two leaves, with the branched plants bearing the flowers and fruit. The sweet fruit is large, up to 2" long, and quickly eaten by wildlife.

36. Dutchman's Breeches
Dicentra cucullaria
Size: 16-30 cm (6-12") tall
Dutchman's breeches are found in Missouri forests. Like many spring woodland wildflowers, they emerge from a tuber or bulb. The fleshy tuber allows them to grow quickly in early spring while sunlight hits the forest floor.

37. Blue Violet *Viola sp.*
Size: 12-16 cm (4 3/4-6") tall
Blue violets are found statewide in forests and meadows. Violet leaves are an important food for the caterpillars of fritillary butterflies and some moths.

38. Mosses *Musci*
Size: less than 20 mm (3/4")
Mosses are simple plants found in many ecosystems. They stay green year-round, serving as food for wildlife and helping hold moisture in the soil.

39. Shelf Mushroom
Polyporaceae
As a forest decomposer, the mycelium or main body of the fungus helps break down dead plant material.

ACTIVITY

A Look at Layers

Overview
Students learn about the layers of a Missouri forest and the plants and animals living in each layer.

Show-Me Standards
Performance:
CA1, FA3, SC3, SC4
Knowledge:
1.3, 1.5, 1.6, 2.3, 4.1

Vocabulary
canopy layer, understory layer, forest floor

Student Objectives
At the end of this activity students will be able to:
1. Name three layers of a forest and describe the functions of each layer.
2. Give examples of plants and animals found in each layer.

Materials
Forests poster, "Layers of Life" copy page

Preparation Time
20 minutes

Class Time
1-2 hours
(Extension–1-2 hours)

Background

A forest is made up of distinctive layers. Each layer has an important function in the forest and provides a particular type of habitat to the birds, insects and animals living there.

The ***canopy layer*** is made up of the branches and leaves, or crowns, of the tallest trees. Trees are producers, converting energy from the sun into food. Consumers like insects, birds and small mammals feed on the leaves and twigs of trees. The fruits produced by trees are food for many species of birds and animals. Some birds like to nest in the canopy layer.

The ***understory layer*** is composed of smaller trees, along with saplings or young canopy trees. Shrubs and vines are found here, too. All of these plants are producers. Consumers living in this layer include birds, insects, spiders, snakes, frogs and small mammals.

The ***forest floor*** has producers, as well. Wildflowers bloom and produce seed in the early spring before they are shaded by the canopy leaves. Mosses and tree seedlings grow in the shade of larger plants. Birds, mammals, reptiles and amphibians feed on insects and plants on the forest floor. Decomposers are an important part of this layer. Fungi, insects and isopods break down fallen leaves, branches and logs, returning nutrients to the soil.

Procedure

1. Hang the *Forests* poster in the classroom. Give each student a copy of "Layers of Life" and the list of species found on the poster. Discuss the needs of plants and animals found in each layer.

2. Have students locate the layer where each of the poster's plants and animals are found. Discuss why each species is found in a particular layer. (Oak and hickory trees need sunlight to produce food. Voles feed on insects and worms on the forest floor. Turkeys eat insects and seeds in the understory layer.)

3. (Optional) Visit your outdoor classroom or a nearby forest. Are there canopy, understory and forest floor layers in this area? Can you find any of the species from the poster here? Did you find any species not shown on the poster? In what layer were they found?

(Extension activity cont. below at right)

COPY PAGE

Name _____

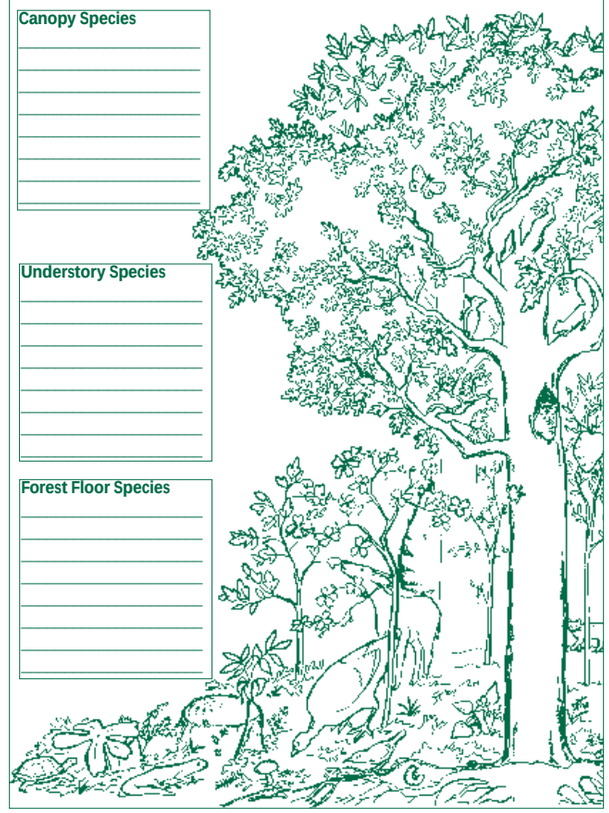
Layers of Life

Label the species from the poster that live in each of the forest layers shown.

Canopy Species

Understory Species

Forest Floor Species



Extension *(cont. from above)*

SUCCESSION

Background

Although we have great forests today, most of Missouri's forests have been cut at some time in the last 150 years. Many mature forests, such as the one on the poster, were converted to agricultural land or cleared for other uses. After a forest or other habitat is cleared or changed, the plants also change.

Succession is the natural replacement of one plant community by another over time. Primary succession begins in areas without soil, such as bare rock. Secondary succession begins on areas with a developed soil layer. It occurs in abandoned fields or forests following wildfire, windstorm or other disturbances. This activity is for secondary succession.

In secondary succession, annual plants, such as ragweeds and sunflowers, are first to grow on the bare soil. They are replaced by perennial plants and woody shrubs, such as blackberry and sumac. These ***pioneer species*** keep the soil from eroding and improve the site so other plants can grow. Pioneer species are replaced by trees. If other disturbances do not occur, a mature forest may develop.

Each successional stage has characteristic animals. Early successional animals find insects, seeds and cover among the pioneer species. Late successional birds and animals require mature forests for their habitat.

Procedure

1. Find a nearby area that exhibits several stages of succession or plan a field trip to a nature center or conservation area. Have students try to find plant communities in different stages of succession. Tell them not to worry about plant or tree names, only types (grasses, non-woody plants, woody shrubs and trees). Have them look for animals and signs or sounds of animals. They should also look for signs of disturbance (erosion, fire, construction and livestock grazing) that might have altered natural succession.

2. Call the students together and discuss the stages of succession at this site. Talk about what factors might alter succession here, including disease, insects, fire, wind, lightning, pollution and drought.

3. Divide the class into teams. Have students draw a general map of the area, including major landmarks and identify and draw areas on the map that fall into the different successional stages identified in the previous step. From the map, ask students to develop a second map predicting what the area will look like in 10 years.

Missouri Forestkeepers Network

Missouri Forestkeepers Network was started in 1996 as a program to monitor forest health in the state. It's designed to educate Missourians about the care and management of Missouri's trees and forests and to enlist volunteer support in monitoring forest health.

For more information or to join the **Missouri Forestkeepers Network**, call toll-free, **(888) 9-FOREST** (888-936-7378) or check out the **Forest ReLeaf Website**, **www.moreleaf.org**.

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